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DYNAMAC CORPORATION
Environmental Services

Peachtree Center Tower
230 Peachtree Street, N.W
Suite 500
Atlanta, GA 30303

Telephone 404-681-0933
Fax 404-681-0894

3 8 1673

August 27, 1993

Mr. Ken Lucas
U.S. EPA Region IV
345 Courtland Street, NE
Atlanta, Georgia 30365

Re: Work Assignment No. C04054 - Remedial Investigation/Feasibility Study Oversight - Olin Corporation, McIntosh, Alabama - Technical Review of Documents - Final Report, Potential Soil Action Levels
Document Control No. C04054-OC-LC-018

Dear Mr. Lucas:

In partial fulfillment of TES VIII Work Assignment No. C04054, Task 3, Dynamac Corporation is pleased to submit for your review two copies of the Technical Review of Documents, Final Report, Potential Soil Action Levels for the Olin Corporation, McIntosh, Alabama, prepared by PRC Environmental Management, Inc. A copy of this Technical Review is also enclosed on a disk in WordPerfect 5.1 format.

If you have any questions or comments, please contact Robert Martin or me at (404) 681-0933.

Sincerely,

DYNAMAC CORPORATION

David L. Rusher
Regional Manager

DLR/smm

Enclosures

cc: Nancy Bethune, EPA Region IV Groundwater Technology Unit
Ken Meyer, EPA Region IV Project Officer
Jack Silvey, Dynamac TES Program Manager
Robert L. Martin, Dynamac Program Manager
Michael Jones, PRC Regional Manager
TES WA File

TECHNICAL REVIEW OF DOCUMENTS 3 8 1 6 7

FINAL REPORT
POTENTIAL SOIL ACTION LEVELS
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

MCINTOSH PLANT SITE, OLIN CORPORATION, MCINTOSH, ALABAMA
PREPARED BY WOODWARD-CLYDE CONSULTANTS, INC.

Dynamac Corporation under contract number 68-W9-0005 from the U.S. Environmental Protection Agency (EPA) requested that its subcontractor, PRC Environmental Management Inc. (PRC), complete the technical review of the Final Report, Potential Soil Action Levels for the McIntosh Plant site, Olin Corporation (Olin), McIntosh, Alabama. Woodward-Clyde Consultants, Inc. prepared the final report for Olin Corporation.

After reviewing the report, PRC has determined that the modeling results, although numerically accurate, were developed using an incorrect technical modeling approach. The SOLUTE modeling software (International Ground Water Modeling Center [IGWMC] 1991), a program package of analytical models for solute transport in groundwater, was inappropriately used to predict fate and transport of contaminant constituents in the unsaturated zone. There are major discrepancies in modeling water flow under saturated and unsaturated conditions. Water in unsaturated soil is strongly affected by suction head gradients, and its movement is subject to considerable spatial and temporal variations in unsaturated hydraulic conductivity resulting from changes in soil water content. Below the water table, groundwater is always under positive hydrostatic pressure which saturates the porous matrix. Thus no suction head gradients or variations in water content normally exist and the saturated hydraulic conductivity is maximal and fairly constant in time, though it may vary in space and direction. For these reasons, the potential soil action levels developed using the SOLUTE modeling results are considered to be inaccurate.

This technical review includes both general and specific comments and recommendations. General comments and recommendations relate to issues that affect the entire report. The specific comments and recommendations, identified by section and page number, relate to shortcomings and deficiencies in the report relating both to the presentation of information and to the derived conclusions.

GENERAL COMMENTS

1. Grouping analytical soil sample results as in Tables 1-2 and 3-1 appears to be questionable and makes interpretation of results difficult. For example, in soil boring BOP1, stiff gray clay from 21 to 27.5 feet below ground surface (bgs) and the interbedded medium gray clay and light gray loose fine sand from 27.5 to 30 feet bgs are grouped in Table 1-2 as the Upper Sands (23 to 30 feet bgs). In addition, the depth range for the "Base of Clay" soil samples (Table 1-2) is not shown and cannot be determined from the soil boring logs in Appendix A. The number of samples, sample concentrations, and corresponding depths for each sample should be included in the report.

2. The conceptual diagram for the SOLUTE modeling approach is not accurate. The SOLUTE model assumes the contaminant source penetrates the full extent of the aquifer with no unsaturated flow component. The source at the McIntosh Plant site is considered the upperfill/waste (4 to 14 feet bgs) and the water table is at 32 to 40 feet bgs. Therefore, an unsaturated flow model should be coupled with a groundwater contaminant transport model for modeling contaminant movement for this site. Three unsaturated flow computer models that would be applicable for modeling at this site are MMSOILS (ICF 1989), MULTIMED (Salhotra et al. 1990), and RUSTIC (Dean et al. 1989).

3. None of the modeling efforts were calibrated and no groundwater sampling results are presented. Results of groundwater samples collected from wells in close proximity to the contaminated areas should be used to verify the modeling results. Once modeling runs are verified, parameters could be modified to iteratively back-calculate the soil action levels to meet the objectives of this study. Representative groundwater data and its interpretation should be included in this report.

4. The recommended potential action levels, as discussed in Section 5.0 of the report, should not be based on any SOLUTE model results. SOLUTE model results were used throughout this report to predict the fate and transport of organic constituents and mercury in the unsaturated zone. The specific SOLUTE analytical model (ONED3) and all other analytical models in the SOLUTE program package (IGWMC 1991) were developed to simulate solute transport in

groundwater. The PESTAN (CSMS 1992) modeling results, as presented in the report, are applicable for estimating transport of constituents through unsaturated soil to the groundwater.

SPECIFIC COMMENTS

1. Section 1.2, Page 2, Paragraph 2. The acronym CPC is not defined. All acronyms used in the report should be defined and a separate list of acronyms should be provided.

2. Section 1.2.1, Page 2, Paragraph 4. The locations of the four soil borings (BOP1 through BOP2) in the Old Plant (CPC) Landfill are not provided in this report. The spacial locations of the soil borings are necessary for interpreting the modeling output. The locations of the four soil borings should be shown on Figure 1-1 or on an additional figure.

3. Section 1.2.2, Page 4, Paragraph 3. The locations of the two soil borings (BCP1 and BCP2) in the Former CPC Plant are not provided in this report. The spacial locations of the soil borings are necessary for interpreting the modeling output. The locations of the two soil borings should be shown on Figure 1-1 or on an additional figure.

4. Section 2.1, Page 9, Paragraph 2. The text states that simulations were conducted in the transient mode to estimate the peak concentration at the bottom of the unsaturated zone. However, the SOLUTE program package ONED3 analytical solution is based on one-dimensional steady-state groundwater flow from a stream. Therefore, changes in the hydraulic gradient and soil water content in time cannot be varied in the SOLUTE model. All information for the SOLUTE model ONED3 analytical solution, as presented in the report, are incorrect.

5. Section 2.1, Page 10, Equations 2-3, 2.3a, and 2-4. Units for the sorption coefficient (K_d) and the normalized chemical-specific organic carbon partition coefficient (K_{oc}) are typically expressed as liters per kilogram (L/kg) rather than grams per grams per grams per cubic centimeter (g/g/g/cc) as in the report. These units should be changed to the more accepted form.

6. Section 2-1, Page 10, Paragraph 3. The EPA reference (1989) is not listed in the references in Section 6.0. This reference should be included.

7. Section 2.1, Page 11, Paragraph 1. Using the SOLUTE program ONED3 model with source reduction rate (β) estimates and other necessary parameters such as vertical seepage velocity and longitudinal dispersivity would provide estimates for concentrations in time at a specified distance from the source. The estimates, however, are simulated concentrations under saturated flow conditions and do not accurately simulate unsaturated flow conditions. All information and results from SOLUTE ONED3 modeling should be correctly applied (See General Comment #2).

8. Section 3.2, Page 21, Paragraph 4. Neither Section 2.1 nor Section 2.2 discuss how the volumetric water content (Θ) used for this modeling effort was calculated or otherwise determined. A discussion of the rationale and determination of $\Theta=0.254$ for the Old Plant (CPC) Landfill and $\Theta=0.133$ for the Former CPC Plant area should be included.

9. Section 3.2, Page 22, Paragraph 1. The seepage velocity input parameter for the SOLUTE model was incorrectly defined and not accurately estimated. The seepage velocity parameter for the SOLUTE model analytical solution is defined as the average groundwater velocity and is calculated from:

$$V_s = \frac{K_{sat}(\delta h/\delta l)}{n}$$

where V_s = the seepage velocity (meters per day [m/d])
K_{sat} = saturated hydraulic conductivity (m/d)
$\delta h/\delta l$ = hydraulic gradient (dimensionless)
n = effective porosity (dimensionless)

Values from the remedial investigation activities, literature, or additional field measurements of K_{sat}, $\delta h/\delta l$, and n should be determined and used to calculate the site-specific groundwater seepage velocity.

10. Section 4.1, Page 27, Paragraph 3. The SOLUTE model output does not accurately predict the fate and transport of organic constituents in the unsaturated zone. Biodegradation rates should be incorporated into a computer model that has unsaturated flow modeling capabilities such as MMSOILS (ICF 1989), MULTIMED (Salhotra et al. 1990), or RUSTIC (Dean et al. 1989). To produce realistic results, the simulation of contaminant transport in unsaturated soil should include the influence of adsorption, volatilization, and degradation. To avoid some of the uncertainty of defining the aquifer mixing depth, the potential soil action levels could be based on estimated concentrations at the water table (point of compliance) rather than at a downgradient well or receptor.

REFERENCES

Center for Subsurface Modeling Support (CSMS). 1992. "PESTAN, Pesticide Analytical Model, Version 5.0." Developed by V. Ravi and J.A. Johnson. Dynamac Corporation, Center for Subsurface Modeling Support. Robert S. Kerr Environmental Research Laboratory. Ada, Oklahoma.

Dean, J.D., P.S. Huyakorn, A.S. Donigan, Jr., K.A. Voos, R.W. Schanz, Y.J. Meeks, and R.F. Carsel. 1989. "Risk of Unsaturated/Saturated Transport and Transformation of Chemical Concentrations (RUSTIC), Volumes 1 and 2." EPA/600/3-89/048a and EPA/600/3-89/048b.

ICF Technology. 1989. "Methodology for Estimating Multimedia Exposures to Soil Contamination." Prepared for Exposure Assessment Group, Office of Health and Environmental Assessment, U.S. EPA, by ICF Technology.

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Salhotra, A.M., P. Mineart, S. Sharp-Hansen, and T. Allison. 1990. "Multimedia Exposure Assessment Model (MULTIMED) for Evaluating the Land Disposal of Wastes--Model Theory." Contract Nos. 68-03-3513 and 68-03-6304.